# CESM Unified Postprocess ing and Diagnostics (CUPiD)

Teagan King, Mike Levy, Will Wieder, Sam Levis, Meg Fowler, Sam Rabin Feb 25th, 2025 - LMWG Meeting





This material is based upon work supported by the National Center for Atmospheric Research, which is a major facility sponsored by the National Science Foundation under Cooperative Agreement No. 1852977.

## **CUPiD** Collaborators

- **AMP:** Dani Coleman, Cecile Hannay, Brian Medeiros, Christina McCluskey, Jesse Nusbaumer, Justin Richling
- CAS: John Fasullo, Adam Phillips, Isla Simpson
- CCR: Gary Strand
- **CSEG:** Brian Dobbins
- **CESM:** Dave Lawrence
- **ESDS:** Katie Dagon, Teagan King, Mike Levy
- ESMF: Bill Sacks
- GeoCAT (CISL): Orhan Eroglu, Katelyn FitzGerald, Anissa Zacharias
- OS: Anna Deppenmeier, Gustavo Marques, Lev Romashkov
- **PPC:** Dave Bailey, Kate Thayer-Calder, Alice DuVivier, Feng Zhu
- TSS: Sam Levis, Will Wieder, Sam Rabin, Meg Fowler, Naoki Mizukami
- Students/Interns: Ingrid Carlson, Cameron Cummins, Shivani Kumar, Hilary Lam



CUPiD is a "one stop shop" that enables and integrates timeseries file generation, data standardization, diagnostics, and metrics from all CESM components.

This collaborative effort aims to simplify the user experience of running diagnostics by calling post-processing tools directly from CUPiD, running all component diagnostics from the same tool as either part of the CIME workflow or independently, and sharing python code and a standard conda environment across components.





## **Current Status**

Key metrics for most components which can run in parallel  $\checkmark$ External diagnostic packages 다 ☆ む 🧌 25 github.com/NCAR/CUPIE  $\checkmark$ NCAR / CUPID Command line arguments 🔗 Edit Pins 👻 O Unwatch 13 Common environment ₽ main -Go to file <> Code -CLIPID is a "one stop shop" that TeaganKing Merge pull request #187 from duvivier/m... -7727ea1 - last week enables and integrates timeseries file generation data **Documentation** .github Update PULL\_REQUEST\_TEMPLAT... last week standardization, diagnostics, and metrics from all CESM cupid Clean up imports in clean and run ... 3 weeks ago components docs update dev env name to infrastruct... 3 months ago a near aithub io/CUPiD Part of CESM Workflow

Support for machines other than Casper / Derecho





#### How Can I Use CUPiD?





## Land Success Story #1: Crop Notebook by Sam Rabin

1.5

1.0

Yield [tC / ha]

soybean

Yield [tC / ha]

wheat

Yield [tC / ha

1.5 2.0 2.5 3.0 3.5

20

3.0

40

Concept: Proved! Sam got CUPiD running and his own notebook was integrated within a few hours of work on Day 1 of the SEWG hackathon!







## Land Success Story #2: Key Metric - Global Terrestrial Coupling Index by Meg Fowler



- Compute land atmosphere coupling index
- Plot seasonal means
- Compare with FLUXNET observations



# Land Success Story #3: ILAMB Integration

- ILAMB is part of CUPiD analysis environment
- Scripts generates configuration files for ILAMB
- Can run ILAMB and view results as part of CUPiD

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Q Search	36	)+	к
Atmosphere			

**External Diagnostic** 

Link to ADF output

Land

Link to ILAMB output

## Key Metrics from ILAMB

Some important things to look at from ILAMB:

► Show code cell source

../../examples/external\_diag\_packages/ILAMB\_output/EcosystemandCarbonCycle/B



../../examples/external\_diag\_packages/ILAMB\_output/EcosystemandCarbonCycle/G





## How Can I Use ILAMB in CUPiD?

#### How to run ILAMB by hand (will be automated in CESM Workflow)

- \$ conda activate cupid-analysis
- \$ export ILAMB\_ROOT=<PATH>/ilamb\_aux

\$ ilamb-run --config <PATH>/ilamb\_nohoff\_final\_CLM\_BGC.cfg --build\_dir

<PATH>/ILAMB\_output/ --df\_errs <PATH>/quantiles\_Whittaker\_cmip5v6.parquet --

define\_regions <PATH>/LandRegions.nc <PATH>/Whittaker.nc --regions global --

model\_setup <PATH>/model\_setup.txt --filter .clm2.h0.

#### CUPiD can provide the necessary input files for ILAMB

- \$ cd CUPiD/helper\_scripts
- \$ ./generate\_ilamb\_config\_files.py --cesm-root \$CESM\_ROOT --cupid-config-loc
- ../examples/external\_diag\_packages --run-type [SP|BGC]

#### Run CUPiD and look at ILAMB output [see top box]

- \$ cd examples/external\_diag\_packages
- \$ [run ILAMB]
- \$ conda activate cupid-infrastructure
- \$ cupid-diagnostics --land
- \$ cupid-webpage



## Land Success Story #4: "LDF" by Will Wieder & Sam Levis

End-to-end workflow for land diagnostics using ADF:

- Create single variable time series and climatologies
- Regrid ne30 data to f09
- Calculate tables of global sums
- Global maps of annual & seasonal means (using raw ne30 data)
- Make web pages

		AMP Diagnostics Pro	totype			
	Case Home Links + About Contact					
Test Case: b.e30_beta05.BLT1850.ne30_t232_wgx3.123 - years: 25 - 44 Baseline Case: b.e30_beta05.BLT1850.ne30_t232_wgx3.122 - years: 25 - 44						
Plot Types						
	Tables	LatLon	TimeSeries			
	Arctic	RegionalClimo	RegionalTimeSeries			
	Special					
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# **Contributing to CUPiD**

- Do you want to add easily accessible diagnostic notebooks to CUPiD?
  - Check out our contributing notebooks guide
  - Add to our repository using this workflow





- If you come across issues or envision new features:
  - Contribute code
  - Create a GitHub issue ticket

